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LLM vs. DLU

NOVEMBER 8, 2023

Large Language Model vs.
Deep Language Understanding
Whence traceable, auditable and reliable answers

DATA, CONTENT, KNOWLEDGE, PROCESS

- In the beginning, nothing really existed, but there was code
- Then we separated code from data
- Then we began adding middleware in tiers

MVC

N-TIER

Where is this all heading?

- In the end will be knowledge, of which code is a wee part

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Language offers the possibility of joining a community, of considering, of concluding.

Without having a name, a thing cannot be understood.

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THE MEANING OF AI IS EVOLVING

Narrow Definition: AI can learn and do new things without any human intervention or coaching (AGI)

Broad Definition: AI does brain tasks better and faster than humans

- Biden's new AI rules apply mostly to FW/BW Chaining Inference
- What about: WolframAlpha computational intelligence

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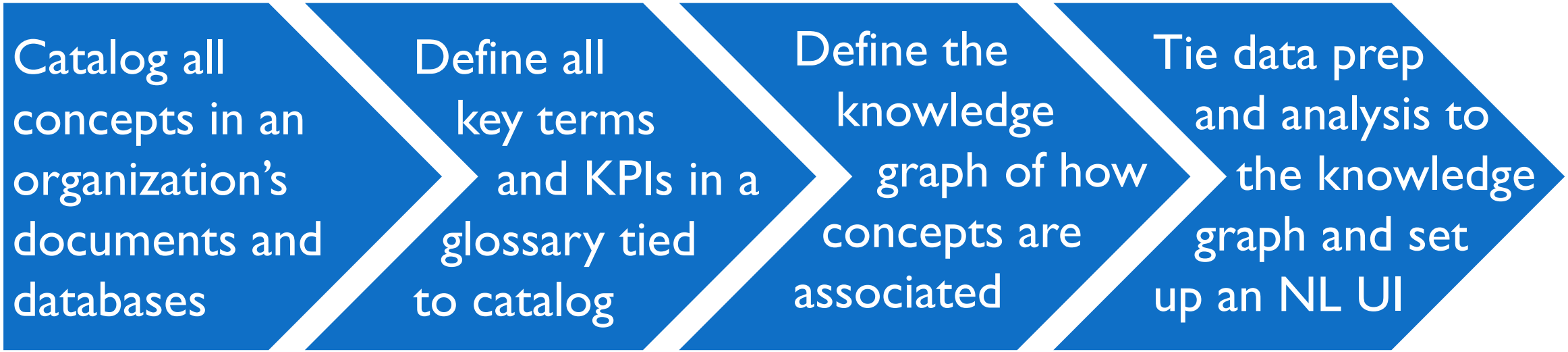
*** DLU is not NLP – NLP is shallow grammar guessing**

WHAT I WILL DESCRIBE TODAY

A graph-based DLU data platform model that uses AI for search and self-service insights easier and more effectively than GPT



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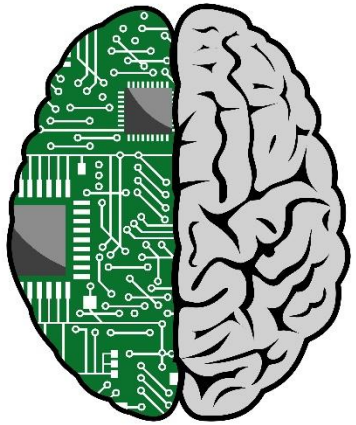
Structural and Functional Modeling:

Neuromorphism



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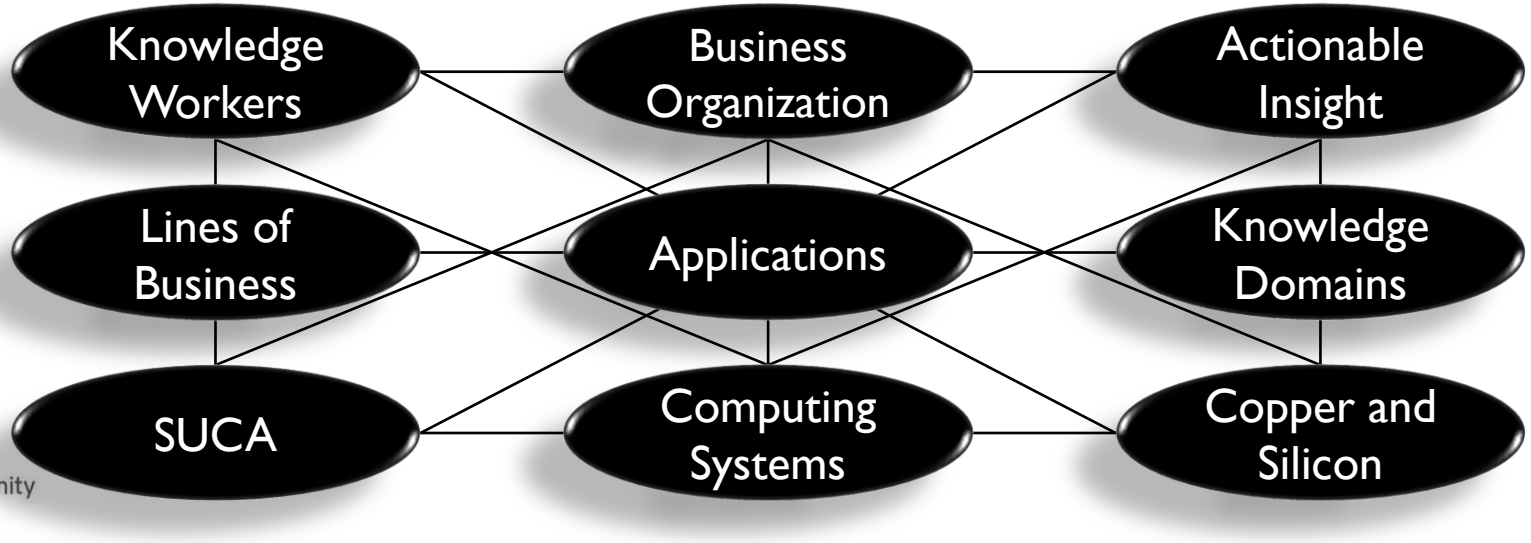
ARCHITECTURE AS GRAPH

"Enterprise architecture is a collection of artifacts describing various aspects of an organization from an integrated business and IT perspective. Practicing enterprise architecture in organizations implies using these artifacts to facilitate information systems planning and improve business and IT alignment." (AI enabled search)



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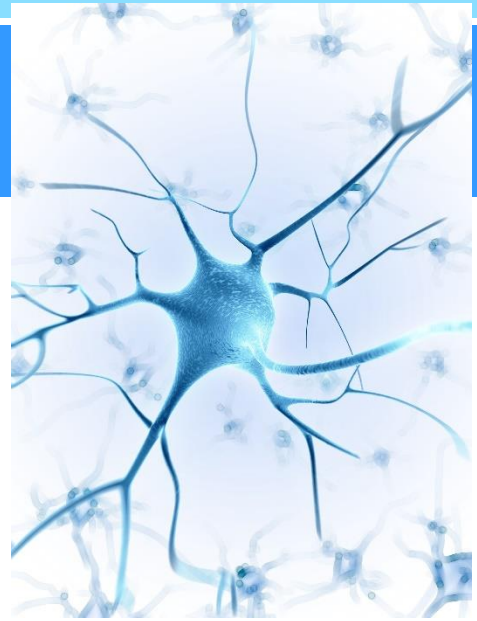
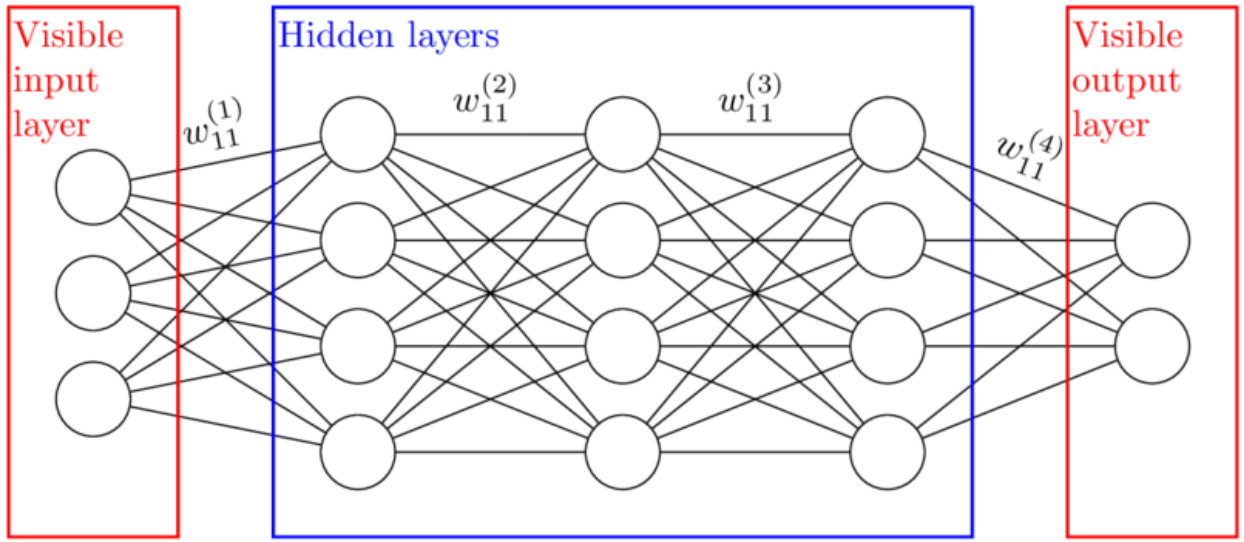
NEURAL NETWORKS AS GRAPHS



- The brain is a network of cells
- Axons and dendrites form links
- Thinking is electrical impulses
- **ANS** use vertices as cells and edges as links

Generative Pre-trained Transformer (GPT) would be the most "neuromorphic" model iff:

Human knowledge is NOT explicitly coded



ANS = Artificial Neural System (ChatGPT, TensorFlow, SKLearn)

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FUZZY STATISTICAL MODELS

- The human brain is a fuzzy reasoning apparatus
- If not, all people would interpret everything the same way
- Neural Networks do fuzzy reasoning
- The bigger the network, the more power
- Bayesian networks can do fuzzy reasoning
- The bigger the network, the more power
- ROM for Neural vs. Baysian Networks:
  - Terabytes vs. Megabytes for the same NL capabilities
  - Petaflops vs. Gigaflops for the same machine learning

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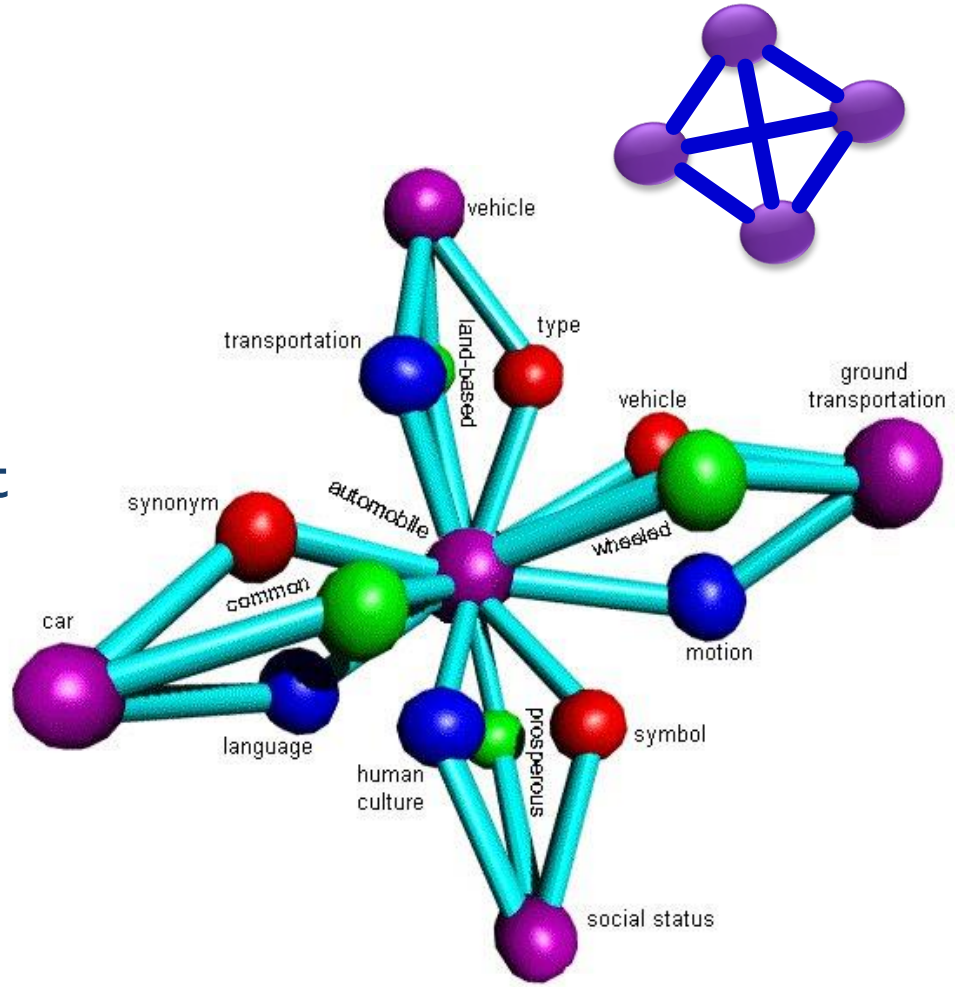
BAYESIAN KNOWLEDGE GRAPHS

- Each vertex in a Bayesian network can contain arbitrarily complex data
- Each vertex in a Bayesian network can be linked to any other vertex
- The cost of link growth is linear so growth must be managed
- Same with the complexity of nodes

Bayesian graphs support apperceptive learning where **implicit** ANS do not



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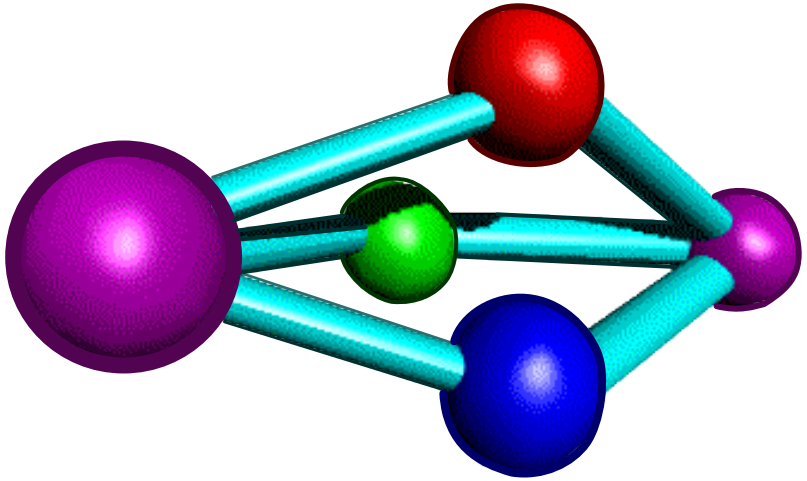
WHOLE-BRAIN PROCESS

High-performance process and knowledge models

- Every knowledge proposition in the ontology is symmetrical:
  - Shows the associations between objects in context
  - Weighting to balance alternate and conflicting possibilities
  - Macro context shows big picture, qualifiers show details
  - Parallel processing in specialized areas of AI "brain"
  - Resolution combines all known factors



Each single node is a knowledge proposition

- Performance is achieved by focus on applicable knowledge only
  - Bypasses anything in the knowledge graph (AI brain) that's not applicable

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Learning Patterns:

Efficiency

3

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TYPES OF TRAINING DATA

- Data on the internet with limited or no provenance (Ownership history)
- Copyrighted Data (Assignment of exclusive ownership)
- Access Controlled Data (Purchased or bartered)
- Best Practice Data (Published practices available for a fee)

(Sam Holcman)

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SUPERVISED VS. UNSUPERVISED LEARNING

"It would be impossible to anticipate all the questions that would ever be asked, so there really is no way that ChatGPT could have been trained with a supervised model. In the context of language modeling, non-supervised pre-training can be used to train a model to understand the syntax and semantics of natural language, so that it can generate coherent and meaningful text in a conversational context" (ZDNET).

If a child can learn using both supervised and unsupervised training, then why not a computer?

FLAVORS OF LEARNING BY REPETITION

- Pattern

1. Repeat the exact same input over and over again
2. Repeated exposure to similar concepts in different inputs
3. Limited exposure to new concepts

- Outcome

LLM learns implicit patterns and connections – DLU N/A

DLU adds new permutations to existing knowledge – LLM N/A

DLU can only learn by linking to known concepts – LLM N/A

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APPERCEPTIVE LEARNING

ap·per·cep·tion /ˌapərˈsepSH(ə)n/
1.the mental process by which a person makes sense of an idea by assimilating it to the body of ideas he or she already possesses. Oxford Languages

- Also "Associative Learning" ties new concept to a known one
- Builds new knowledge on a-priori knowledge
- Never needs retraining, but prior knowledge can be changed
  - Associations and propositions can be reinforced or undermined

APPERCEPTIVE LEARNING APPROACHES

1. **Source** Oriented Learning (Example curated LOD)
2. **Domain** Oriented Learning ((Example Marine Biology)
3. Opportunistic with **Source List** (Like LLM but one-pass)
4. Opportunistic **Link Seeking** (Usually constrained by depth)

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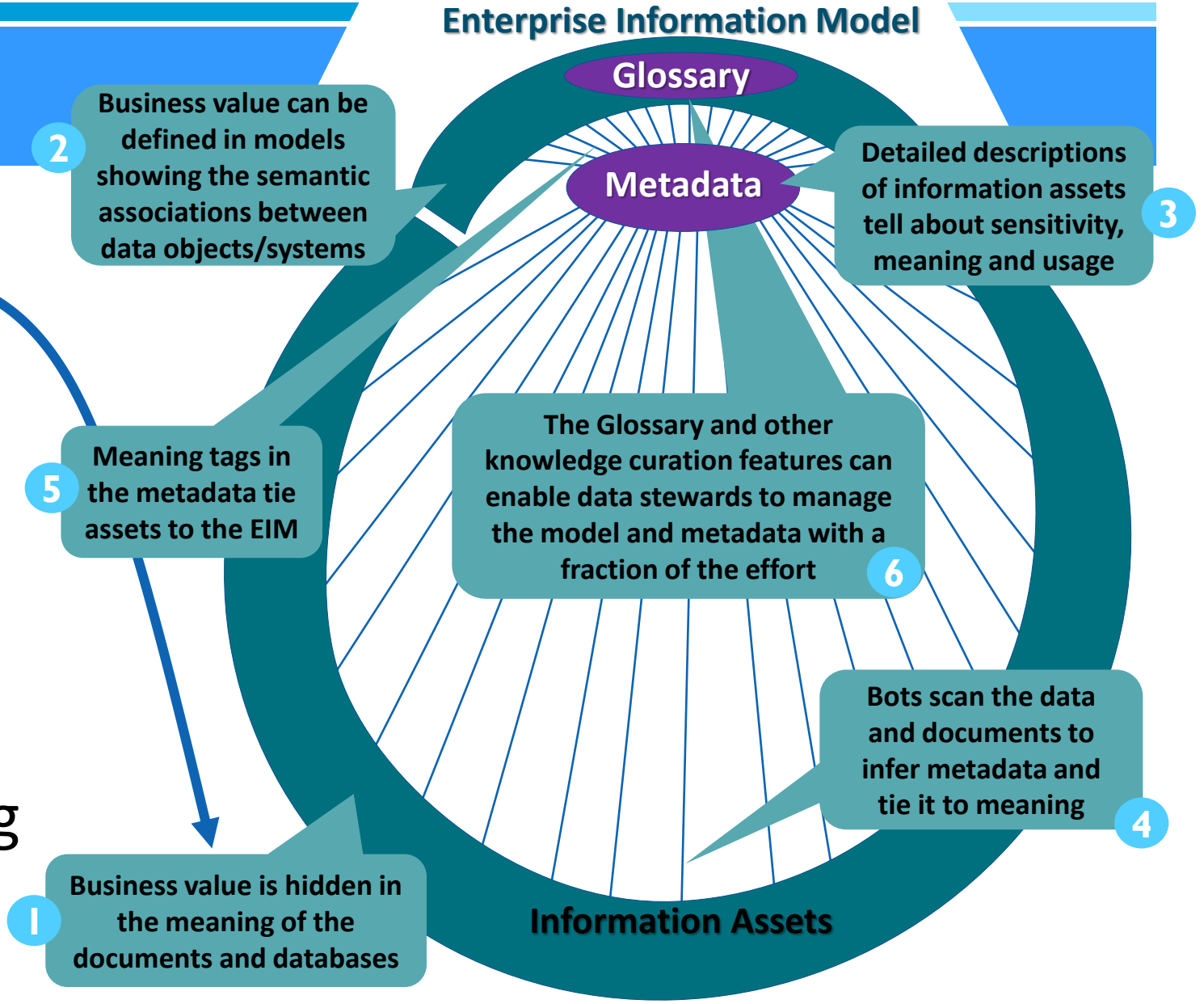
CONCEPT-DISCOVERY

- Understanding Meaningfulness
- Enterprise Information Modeling (EIM)
- Secure Semantic Metadata
- Indexing, Docs, DBs, Big Data and Apps



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Strengths and Weaknesses of ANS-Based LLM:

Flexibility vs. Reliability

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LLM IS HALF-BRAINED

- The LLM demands massive computational resources
  - GPT guesses the best answer based on learned patterns, not intent
  - It can't approach human competence in communication
  - It can't understand metaphor, sarcasm, irony or multiple-meanings
- Our conceptual knowledge network is resource frugal
  - It can understand and respond to the intent of the user
  - It can find ambiguities and bias and ask the right questions to clarify
  - It can approach human competence in communication
  - It can understand metaphor, sarcasm, irony and multiple-meanings

FUNCTIONAL COMPARISON

Function	LLM	DLU
Code Writer		
Fiction Writer		
A Style Imitator		
An Interpreter		
A Clarifier (Prompt Generator)		
A Bias Detector/Meter		
A Halucinator		
A Fake News Conduit		
An Automatic Language Learner		
An Omni-Directional Translator		

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EXPLAINABILITY AND ATTRIBUTION

1. **Explainability**	Describe the complete reasoning process chain and data that led to the answer
2. **Attribution**	Provide bibliographic references pointing to the source of quotes and interpretations
3. **Evidence**	Provide external corroborating information to support answer

EXAMPLE ENTERPRISE AI ARCHITECTURE

- Where does it fit?
- What does it do?
- How does it interact with systems?
- How does it interact with data?
- How does it interact with people?